

(C-002-D) DC-DC Boost Converter (Discrete)

Simulation Parameters (Dialog)

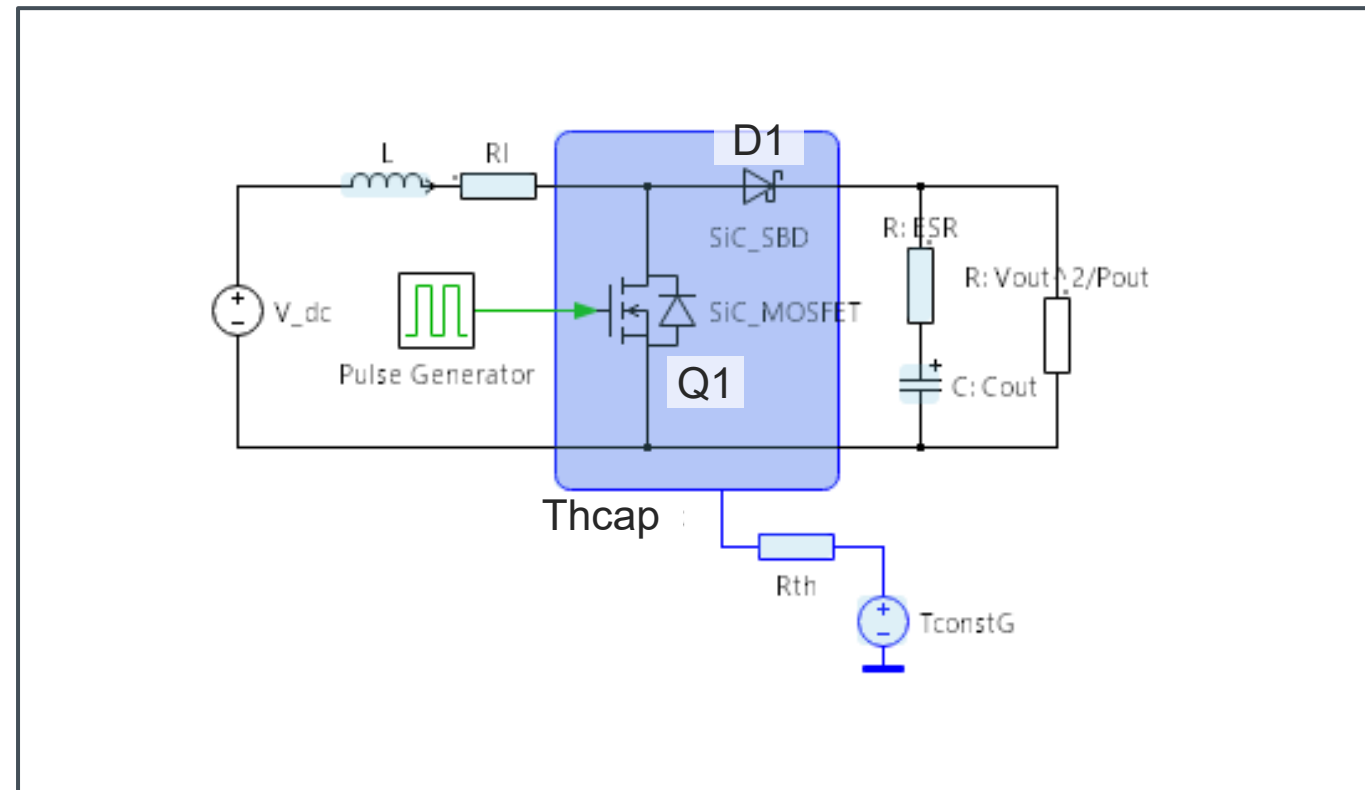
Name	Content	unit	Default Value	Variable Range
L	Inductive Load	H	1.2m	1n ~ 1
RI	Parasitic Resistance	Ω	100m	1u ~ 100m
Cout	Output Capacitor	F	100u	1n ~ 1
Vc_init	Initial Voltage of Cout	V	500	0 ~ 1200
ESR	Equivalent Series Resistance	Ω	10m	1u ~ 100m
Rth	Thermal Resistance	K/W	0.5	1m ~ 100
Thcap	Thermal Capacitance	J/K	10m	1m ~ 1000
TGND	Thermal GND Temperature	$^{\circ}\text{C}$	25	-40 ~ 175

Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.3	100u ~ 0.5
fs	Switching Frequency	Hz	50k	10k ~ 100k
Vin	Input Voltage	V	400	1 ~ 1000
Vout	Output Voltage	V	800	10 ~ 1200
Pout	Output Power	W	3.3k	1 ~ 10k
Rg_on	Gate Resistance (Source)	Ω	6.8	0 ~ 100
Rg_off	Gate Resistance (Sink)	Ω	6.8	0 ~ 100
T_init	Initial Junction Temperature	$^{\circ}\text{C}$	25	-40 ~ 175

Simulation Circuit

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Power Devices

Name	Device Type	Part No.	Specification
Q1	SiC MOSFET	SCT4036KR	1200V/ 43A/ 36m Ω / TO-247-4L
D1	SiC Schottky Barrier Diode	SCS320KG	1200V/ 20A/ TO-220ACGE

Simulation Screen Overview

Schematic window
• Dialog parameters setting
• Results display

Simulation control

Trace selection

Table parameters setting

The screenshot displays the ROHM PLECS Simulator interface, which is divided into several functional areas:

- Schematic window (top left):** Shows a circuit diagram of a power MOSFET driver. A text box above it states: "Clicking blue-colored symbols will allow you to change the parameters." The schematic includes components like a Pulse Generator, V_{dc}, L, R_l, SIC_MOSFET, SIC_SBD, R_{ESR}, R_{th}, C_{out}, Z_{out}, and a Heat Sink. It also features sections for "Input / Output", "Electrical", "Thermal", "Input / Output Loss", and "Thermal" parameters.
- Simulation control (middle left):** Contains buttons for "Start-Up", "Steady-state", and "Hold Result", along with a "Simulation Completed" status indicator.
- Trace selection (bottom left):** Shows a list of traces, including "[file:SCT4036KR], SCS320KG (1200V/20A/TO-220ACGE), Trace 1".
- Table parameters setting (bottom left):** A table for setting device parameters:

Parameter	Value	Unit
Rg_on	6.8	ohm
Rg_off	6.8	ohm
Initial Junction Temperature	25	deg.C
- Waveforms (right side):** A series of plots showing simulation results over time (0.0 to 0.8 x 10⁻⁴ s):
 - Vin [V]:** A constant input voltage of 400V.
 - lin [A]:** A triangular current waveform oscillating between approximately 6.5A and 10A.
 - Vout [V]:** A triangular output voltage waveform oscillating between approximately 796.6V and 797.2V.
 - Iout [A]:** A triangular output current waveform oscillating between approximately 4.107A and 4.110A.
 - SIC MOSFET [V]:** A square wave switching between 400V and 800V.
 - Heatsink Temp. [C]:** A triangular temperature waveform oscillating between approximately 32.4525867008°C and 32.4525867012°C.

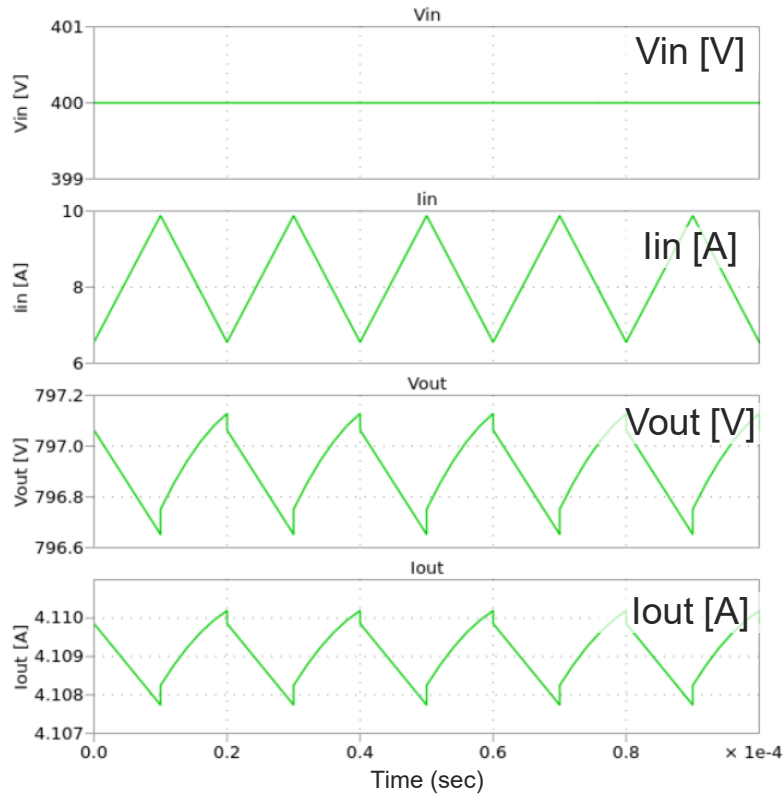
Waveforms

Simulation Results

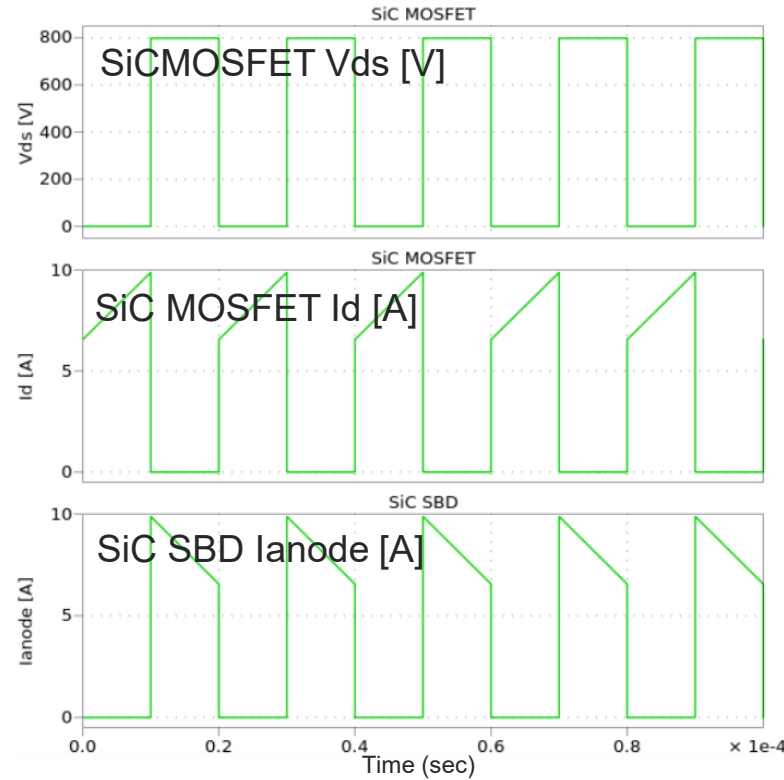
Simulation Mode: Steady State

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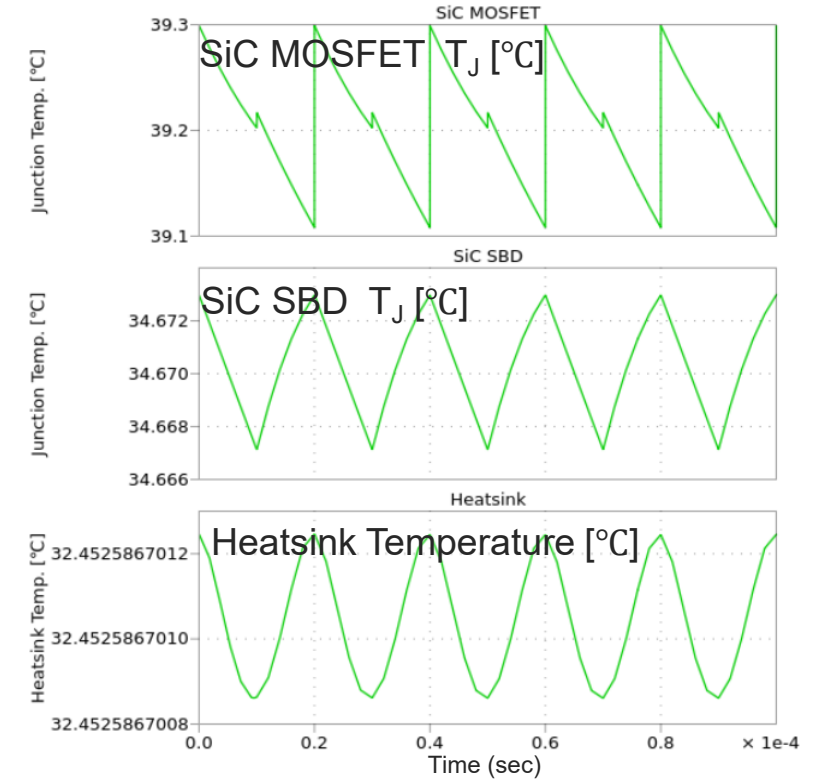
Input and Output



Electrical



Thermal



Contents	Results
Input Power : Pin	3.298 kW
Output Power: Pout	3.275 kW
Efficiency: η	99.30 %

Contents	Results
Conduction Loss (SiC MOSFET)	1.41 W
Switching Loss (SiC MOSFET)	8.99 W
Total Loss (SiC MOSFET)	10.40 W
Conduction Loss (SiC SBD)	4.51 W
Loss (Others)	7.02 W

Contents	Results
Tj (SiC MOSFET)	39.30 °C
Tj (SiC SBD)	34.67 °C
T_Heatsink	32.45 °C

How to change the devices

The figure of "(A-011-D) DC-AC Totem-Pole PFC Diode Rectification (Discrete)" is used as an example in this page.

You can select the simulation devices at "Step-2: Device Selection"

Step 2: Device Selection

Please check the checkboxes of the devices you want to simulate (Square checkboxes allow you to select up to three devices simultaneously.)

You can also select IDEAL devices (no-loss).

In addition, clicking PDF icon will allow you to view the datasheet of the certain device.

SIC-MOSFET Block

Selected: 1/3 **SCT4065DR X**

Select	Part Number	VDS [V]	Drain Current [A]	R _{DS(on)} [mΩ] (Typ.)	Package
<input type="checkbox"/>	SCT4090KWA	200	17	90.0	TO-263-7LA
<input type="checkbox"/>	SCT4090KR	200	19	90.0	TO-247-4L
<input type="checkbox"/>	SCT4090KE	200	19	90.0	TO-247N
<input type="checkbox"/>	SCT4065DWA	750	22	65.0	TO-263-7LA
<input checked="" type="checkbox"/>	SCT4065DR	750	25	65.0	TO-247-4L
<input type="checkbox"/>	SCT4065DLL	750	26	65.0	TOLL
<input type="checkbox"/>	SCT4065DE	750	25	65.0	TO-247N
<input type="checkbox"/>	SCT4065DK	200	24	62.0	TO-263-7LA

SIC-SBD Block

Selected: SCS320AG

Select	Part Number	Reverse Voltage [V]	Continuous Forward Current [A]	Package
<input type="radio"/>	SCS320KN	1000	20.0	TO-263-2L
<input type="radio"/>	SCS320KG	1000	20.0	TO-220AC
<input type="radio"/>	SCS320AM	600	20.0	TO-220FM
<input type="radio"/>	SCS320AJ	600	20.0	LPTL
<input checked="" type="radio"/>	SCS320AG	600	20.0	TO-220ACGE
<input type="radio"/>	SCS315KN	1000	15.0	TO-263-2L

Selected Products

- SIC-MOSFET SCT4065DR
- SIC-SBD SCS320AG

Selected device names are shown here.

SCT4065DR
N-channel SiC power MOSFET

V _{DSS}	750V
R _{DS(on)} (Typ.)	65mΩ
I _D ⁻¹	25A
P _D	88W

Features

- Low on-resistance
- Fast switching speed
- Fast reverse recovery
- Easy to parallel
- Simple to drive
- Pb-free lead plating ; RoHS compliant

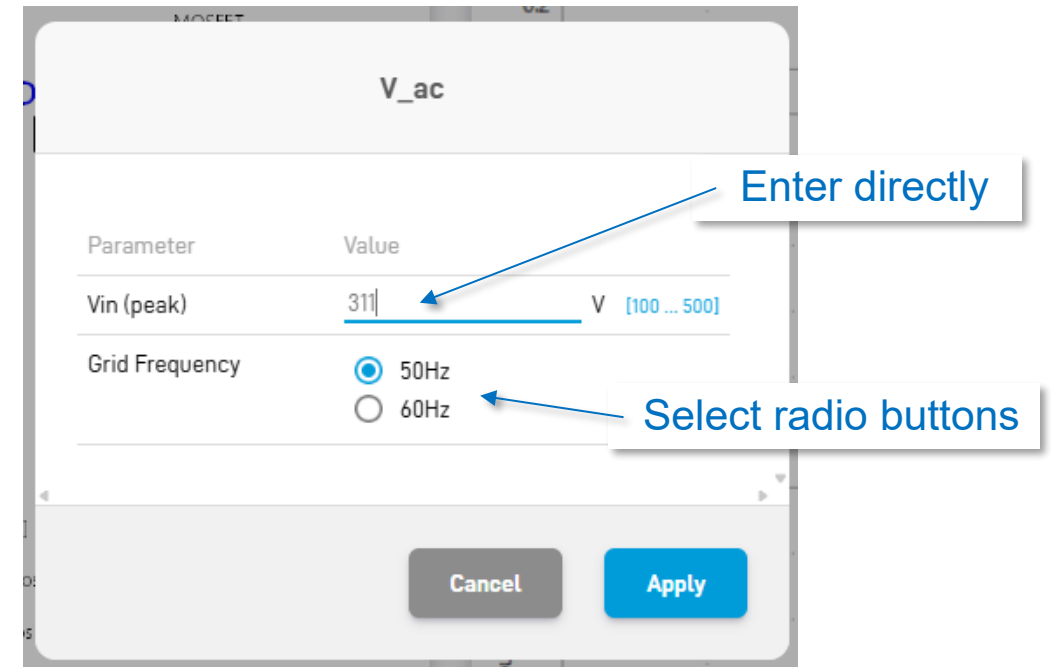
How to change Dialog parameters

The figure of "(A-011-D) DC-AC Totem-Pole PFC Diode Rectification (Discrete)" is used as an example in this page.

- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. "V_ac" symbol in the below).
- Click the mouse's left button.



- A new window like the below is opened.
- You can change the parameters by entering the value directly* or selecting radio buttons.
- Push "Apply" button after changing all parameters.



*Note: Parameters can be entered directly are limited by Min. and Max. values to avoid unexpected system errors.
(e.g. "Vin(peak)" is limited between 100 and 500V in the above.)

Table parameters

The diagram illustrates the process of changing a parameter in a table. It shows two screenshots of a parameter table. In the first screenshot, the 'Switching Frequency' parameter is set to 60000 Hz. A hand cursor points to the value, and a yellow arrow points down to the second screenshot. In the second screenshot, the 'Switching Frequency' parameter is set to 20000 Hz, and the value is underlined in blue. A blue range [10000 ... 100000] is displayed next to the unit 'Hz'.

Parameter	Value
Test_time	1 sec
Switching Frequency	60000 Hz

Parameter	Value
Test_time	1 sec
Switching Frequency	<u>20000</u> Hz [10000 ... 100000]

Choose the parameter that you want change on the parameter tables (e.g. "60kHz" of Switching Frequency in the left figure.)

- A blue under-line and variable range of the parameter are appeared.
- Then, you can change the parameters by entering the value directly " (e.g. "60kHz" was changed to "20kHz").

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